PHYSICO CHEMICAL STUDIES OF THE POLYMERIC BLENDS OF SOME VEGETABLE OIL BASED EPOXIES AND POLYESTERAMIDES

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It is a common experience that no known or existing polymer can satisfy specific and diverse property demands without being selectively or appropriately modified physically or chemically in tune with set properties and objectives. We can combine two polymers with different properties to get a new material with some of the properties of the both to meet the new technological demand. Modification of properties can be done by copolymerisation, blend formation and through formation of composites.

Polymethyl methacrylate is a hard, transparent polymer with good weathering resistance. Its principal limitation is its brittleness, which makes it crack easily when little stress is applied on it.

Poly (vinyl alcohol) has, high impact strength. Its and hardness increases with molecular weight and varies inversely with moisture content. Abrasion resistance is as good as that of cotton. It is water soluble and is much affected by moisture and high humidity creep under load.

Poly (methacrylic acid), [PMA] is a hard, brittle & water-soluble polymer. Its films have therefore have low impact resistance and show susceptibility to crack.

The shortcomings of the above commercial polymers can be overcome either through copolymerization or blending for wide commercial/ engineering application. We have used vegetable oil epoxies and vegetable oil polyesteramides for blending of the above polymers for the modification of their properties especially their brittleness.

In the present work polymer blends of epoxies and polyester amides of dehydrated castor oil and linseed oil with poly (methyl methacrylate), poly (vinyl alcohol) and poly (methacrylic acid) of varying compositions were synthesized.

The properties of polymer blends vary depending on the nature and miscibility / compatibility of their constituents. Only blends which are compatible are known to show stable physical and mechanical properties over a period of time. Investigation of compatibility in any blend system is therefore, imperative.

The blends were studied by various techniques to establish compatibility, semicompatibility and incompatibility of the components both in solution and solid phases. The techniques employed were viscosity and ultrasonic velocity measurements

of solutions, scanning electron microscopy, differential scanning colorimetry for the films along with the qualitative evaluation of mechanical characteristics of the films.

The thesis has been divided into Seven Chapters.

Chapter 1 Introduction and literature review

Chapter 1 deals with the general introduction and literature survey on polymer blends in general and blends of PMA, PMMA, PVA, Epoxy and Polyesteramide in particular. It also gives an account of the mechanical properties of synthetic polymers. The scope of the present work, objectives and plan of the thesis have also been described in this chapter.

Chapter 2 Experimental

Chapter 2 incorporates the experimental, techniques, materials and methods. It provides the polymerization methods of PMA and PMMA and their molarmass determination. PVA used in these studies was, "s.d. Fine chem. product". The dehydrated castor oil epoxy (DCOE), linseed oil epoxy (LOE), dehydrated castor oil polyestermide and linseed Polyesteramide were synthesised in the laboratory by reported methods.

The synthesised polymers were purfied by solvent-nonsolvent method. Techniques employed in these studies, namely viscosity measurement, ultrasonic velocity measurement, differential scanning calorimetry (DSC), thermogravemetric analysis (TGA) and SEM have been discussed in this chapter.

Chapter 3 Physico chemical and structural studies on the formation of blends by dehydrated castor oil epoxy with poly (methacrylic acid) and poly (methyl methacrylate)

Chapter 3 presents the details of the blend formation of dehydrated castor oil epoxy with Poly (methacrylic acid) and Poly (methyl methacrylate) in solution. DCOE : PMA/PMMA blends were studied by viscometric and ultrasonic methods in solution and by DSC, TGA and SEM of their films.

Conclusion

- The Blends of dehydrated Castor oil epoxy with ploy (methacrylic acid) were found to be compatible.`
- The Blends of Dehydrated castor oil epoxy with poly (methyl methacrylate) were found to be incompatible.

Chapter 4 Physico chemical and structural studies on the formation of blends by linseed oil epoxy with poly (methacrylic acid) and poly (vinyl alcohol)

Chapter 4 is focused on the physico chemical studies of linseed oil epoxy with PMA and PVA blends. The blends of LOE with PMA and PVA were prepared in weight ratios LOE :

PMA/PVA, 100 : 0, 80 : 20, 60 : 40, 40 : 60, 20 : 80, 0 : 100, in 2% and 4% solutions in DMSO. Blends were characterised by viscosity measurement, ultrasonic velocity measurement, DSC, TGA and SEM analysis.

Conclusion

- The blends of linseed oil epoxy with poly (methacrylic acid) were found to be semi compatible.
- The blends of linseed oil epoxy with poly (vinyl alcohol) were found to be nearly compatible.

Chapter 5 Physico chemical and structural studies on the formation of blends by dehydrated castor oil polyesteramide with poly (methacrylic acid) and poly (vinyl alcohol)

This chapter gives the information on the formation of blend between dehydrated castor oil polyesteramide (DCPEA) and poly (methacrylic acid), [PMA], as well as Poly (vinyl alcohol) [PVA]. The blend of DCPEA and PMA/PVA were prepared in weight ratios DCPEA : PMA/PVA, 1 : 0.2, 1 : 0.4, 1 : 0.8, 1 : 1.2, 1 : 1.6, 1 : 2.0, 1 : 2.4 and 1 : 2.8 in dimethyl sulphoxide. Blends were characterised by viscosity measurement, ultrasonic velocity measurement, DSC, TGA and SEM.

Conclusion

- The blends of Dehydrated Castor oil polyesteramide with poly (Methacrylic acid) were found to be incompatible.

- The Blends of Dehydrated Castor oil Polyesteramide with poly (Vinyl Alcohol) were found to be incompatible.

Chapter 6 Physico chemical and structural studies on the formation of blends by linseed oil polyesteramide with poly (methacrylic acid) and poly (vinyl alcohol)

LOPEA : PMA blends

Chapter 6 is focused on the physico-chemical studies on the formation of blends by linseed oil polyesteramide [LOPEA] with poly (methacrylic acid) [PMA] and poly (vinyl alcohol) [PVA]. The blends of LOPEA and PMA/PVA, were prepared in weight ratios LOPEA : PMA/PVA, 1 : 0.2, 1 : 0.4, 1 : 0.8, 1 : 1.2, 1 : 1.6, 1 : 2.0, 1 : 2.4 and 1 : 2.8 in dimethyl sulphoxide. Blends were characterised by viscosity, ultrasonic velocity, DSC, TGA and SEM.

Conclusion

- The blends of linseed oil polyesteramide with poly (methacrylic acid) were found to be incompatible.

- The Blends of linseed oil polyesteramide with poly (Vinyl Alcohol) were found to be

incompatible.

Chapter 7 Rheological studies of concentrated blend solutions of oil based epoxies and polyesteamides with some commercial polymers

Conclusion

- Rheological study of the above blends further confirm the above conclusions.